Allotment Optimisation Strategies for Camping Revenue Management

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1 Campsite Revenue Management Context

In the tourism industry, an allotment is a block of pre-negociated "rooms" or "seats" which have been bought out by a travel agency or a tour operator. In the context of campsites, allotments play an important role in the distribution process and represent a significant share of the mobile homes sales. Having 20% of the inventory sold via allotment is not uncommon. The discount offered to the tour operators can go up to 50% according to the campsites and tour operator respective negotiating power.

Once the tour operator has contracted the allotement – say 20 mobile home weeks starting on the 1st of August in a four star campsite near Nice – its roles is to resell the mobile home weeks to final customers through its networks and channels. For each allotment contract, a release back period is negotiated, typically 30 days before the check-in, where the tour operator can release a part of the unsold block, with or without penalties. The campsite will then be obliged to sell the remaining mobile homes by its own means.

For the campsite owner, dealing with tour operator allotment requests is a poisoned chalice. On one hand these pre-booked sales are more or less a guarantee of selling a good share of its inventory with little effort, early in the sales time frame. More-over, if the tour operator is well exposed to say, the Belgium market, these sales will fill holes in the capacity of a French campsite. On the other hand, the discount level – according to the negotiating power of the tour operator – is so high that selling the whole inventory through allotements would potentially ruin the campsite business. Hence, a balance must be found between allotement contracts and estimated direct sales to final customers (at full price, or lightly discounted price). If allotments volumes and prices are known in advance, early in the season, the final customer demand is only known by forecast, 6 to 9 month in advance. What is more, tour operators ask for large quantities (take or leave), that are more efficiently sold on the web, which increases the risk for the campsite.

2 The Campsite Allotment Optimisation Problem

For the revenue manager of a campsite, or a group of campsites, who receives allotment requests coming from dozens of tour operators at the opening of the sales, the issue is to take the strategy (accepting or refusing each allotment request) that maximizes its revenue expectancy.

For a given arrival date D, each allotment is characterized by a quantity Q and a price P. A release date R, a few weeks before D is in general settled by contract. We consider that we know for each q less or equal to Q the probability that q units of inventory will be released at R by the tour operator. The optimisation problem consists in taking the optimal set of decisions for all tour operator requests, with respect to capacity constraints according to final customer demand forecasts for the main fare classes when the campsite sells by its own means.

The purpose of our presentation is to show that the stochastic optimisation problem at stake is highly combinatorial and that algorithmic approaches relying on continuous relaxations of the demand behave poorly when the ratio “size of the allotment on total campsite capacity” is high. More-over, introducing recourse strategies, like promotions after the release dates, might advocate for higher risk taking in the allotment phase. Those recourses are difficult to exploit through “displacement” models or deterministic “bid price” policies frequently used by classic Revenue Management methods.
Our experiments results will compare optimal strategies – using Markov Decision Process models – to fluid approaches and ad-hoc heuristics, exploiting the combinatorial structure of the problem.

When the overall demand is fixed, we will show that the RevPAMH (average revenue per available mobile home) is not a decreasing function of the capacity, due to the loss induced by the allotment discrete sizes and the “tetris effect” of their combination. This effect is not fully compensated by the “yield management” effect on the demand.

3 Extension to the Multi-Site Allotment Optimisation Problem

Some large tour operators, with high negotiating power may ask for multi-site allotements to a group of campsites. For a group having hundreds of campsites in Europe, the decision to take is no more local, a given service level rate having to be fulfilled for each of these tour operators. The discount rate proposed by the tour operator might be closely related to the service level reached by the camping group.

As expected, the MDP approach becomes a victim of the curse of dimensionality of Bellman and finding an optimal strategy for a set of 100 campsites is out of reach through dynamic programming. Thus, we developed a decomposition technique based on a Lagrange relaxation of the service level constraint of each tour operator. The master problem of fixing the Lagrange multipliers is solved by the subgradient algorithm when the sub-problems takes into account the stochastic dimension of the problem, through MDP modelling and straightforward backward induction.

We will compare our approach with greedy strategies (fixing decisions campsite after campsite until service level satisfaction) and will provide experimental results on 200 campsites, 25000 mobile homes and 15 tour operators benchmarks with data sets inspired by a European leading company in the campsite industry.

Références

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